

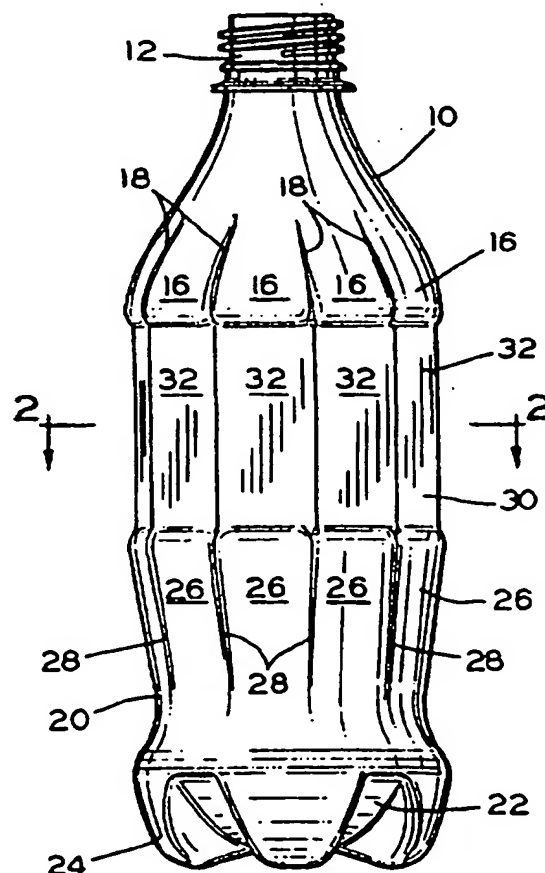


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(21) International Application Number: PCT/US96/14897 (22) International Filing Date: 17 September 1996 (17.09.96) (30) Priority Data: 08/529,744 18 September 1995 (18.09.95) US 08/529,500 18 September 1995 (18.09.95) US (71) Applicant: PLASTIC TECHNOLOGIES, INC. [US/US]; 1465 Timberwolf Drive, Holland, OH 43528 (US). (72) Inventors: BRADY, Thomas, E.; 5432 Radcliffe Road, Sylva- nia, OH 43560 (US). CARROS, Thomas, J.; 1002 Clarion, Holland, OH 43528 (US). GROLL, Robert, J.; 925 Hanson Street, Northwood, OH 43619 (US). JACKSON, Robert, H.; 11014 Hedwig Green, Houston, TX 77024-6801 (US). (74) Agent: FRASER, Donald, R.; Law Offices of Donald R. Fraser, 6th floor, Four SeaGate, Toledo, OH 43604 (US).		(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>

(54) Title: CONTAINER WITH STIFFENING IN CENTRAL PANEL**(57) Abstract**

A plastic container of the type suitable for containing carbonated beverages is provided with a central section (30), an upper section (10) including a threaded neck portion (12), and a lower base section (20). The base section (20) includes radially arrayed concave foot portion (24) to support the container in an upright position. The central section (30) includes a reinforcement structure which is a series of panels which tend to blend together to form a circular cross-sectional configuration when under pressurization.



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TITLECONTAINER WITH STIFFENING
IN CENTRAL PANEL

5

BACKGROUND OF THE INVENTION

The invention relates to a plastic container and more particularly, to an improved plastic container structure of the type suitable for containing carbonated beverages.

The bottling of carbonated beverages in plastic
10 containers presents a number of problems, many of which arise in connection with the structure of the central portion of the container, particularly when the overall plastic content is decreased in weight. Mere plastic duplication of the traditional glass bottle design
15 configuration is deemed unsatisfactory for a myriad of reasons, one of which is the tendency of the resultant container to feel somewhat flimsy in the hand of the ultimate user. Also, mere duplications in plastic sometimes are unsatisfactory due to the fact that plastic
20 materials have a tendency to creep or become otherwise distorted when the containers are filled with carbonated beverages or other fluids under pressure. Such distortion may alter the shape and dimensions of the container configuration which tends to adversely affect the
25 application of indicia containing outer wraps and result in a distortion of the wrap and integral indicia.

The above noted problems can threaten customer acceptance or satisfaction of the product within the container.

A plastic container, when filled with a carbonated beverage and capped, must be able to withstand the impact
5 of falling from at least a moderate height and must be dimensional stable in respect of the outer shape and dimensions to enable the container to be of the same capacity as glass containers so that they may be handled or processed by existing equipment and assist in
10 customers' identification of the particular product contained therein. Aesthetic appearance is typically a given requirement.

Also, when the plastic container becomes distorted by the internal pressure, it may become unstable on a
15 horizontal surface. Such instability may result in a probability of an adverse customer reaction toward the container contents.

The prior art is replete with disclosures of plastic container structures illustrating and describing improved
20 bottom structures for plastic containers of the type suitable for containing carbonated or effervescent beverages.

However, the aspects of the side wall configuration have only relatively recently attracted attention
25 primarily due to the desideratum on the part of beverage bottlers to reduce the overall weight of the plastic

material required to form the container. Also, with the advent of the use of plastic sheet overlays on the container, it has become necessary to direct considerable attention to the dimensional stability aspects of the central section of the container adapted to support the overlay.

SUMMARY OF THE INVENTION

In accordance with the present invention, an improved plastic container of the type suitable for carbonated beverages, for example, has been developed. Such new container contains a central section having a portion thereof which tends to change or vary at least in the outermost configuration as a result of internal pressurization, typically due to the presence of a carbonated beverage. More specifically, the portion is caused to assume or approach a circular cylindrical shape upon pressurization and thence will return to its original shape upon depressurization due to the memory of the plastic material forming the container wall.

More objects, features, and advantages of the invention will become readily manifest to those skilled in the art from reading the following detailed description of a preferred embodiment of the invention, when considered in the light of the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an elevational view of a container having a central section constructed in accordance with the invention;

5 Figure 2 is a cross-sectional view of the container illustrated in Figure 1 taken along line 2-2 thereof;

 Figure 3 is an elevational view of the container of Figures 1 and 2 illustrating the configuration of the central section after the container has been filled with a
10 pressurized fluid and capped;

 Figure 4 is a cross-sectional view of the container illustrated in Figure 3 taken along line 4-4 thereof;

 Figure 5 is an elevational view of an alternative embodiment of the container illustrated in Figures 1 to 4
15 having a central section constructed embodying the features of the invention;

 Figure 6 is a cross-sectional view of the container illustrated in Figure 5 taken along line 6-6 thereof;

 Figure 7 is an elevational view of the container of
20 Figures 5 and 6 illustrating the configuration of the central section after the container has been filled with a pressurized fluid and capped;

 Figure 8 is a cross-sectional view of the container illustrated in Figure 7 taken along line 8-8 thereof.

25

Figure 9 is an elevational view, partially cut-away, of a container having a central section constructed in accordance with the invention;

Figure 10 is an elevational view of the container
5 illustrated in Figure 9 illustrating the configuration of the central section after the container has been filled with a pressurized fluid and capped;

Figure 11 is a fragmentary view, partially cut-away, of an embodiment of the container illustrated in Figures 9
10 and 10;

Figure 12 is a fragmentary view, partially cut-away, of another embodiment of the container illustrated in Figures 9 and 10;

Figure 13 is a fragmentary elevational view of
15 another embodiment of the invention;

Figure 14 is a fragmentary sectional view of the embodiment illustrated in Figure 13 taken along line 14-14 thereof;

Figure 15 is a fragmentary elevational view of
20 another embodiment of the invention;

Figure 16 is a fragmentary sectional view of the embodiment illustrated in Figure 15 taken along line 16-16 thereof;

Figure 17 is a fragmentary elevational view of
25 another embodiment of the invention;

Figure 18 is a fragmentary sectional view of the embodiment illustrated in Figure 17 taken along line 18-18 thereof;

Figure 19 is a fragmentary elevational view of
5 another embodiment of the invention; and

Figure 20 is a fragmentary sectional view of the embodiment illustrated in Figure 19 taken along line 20-20.

10 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, there is illustrated a plastic container constructed generally in accordance with the teachings of the invention and is preferably formed of a thermoplastic material having gas barrier properties to
15 such a degree that the container will be suitable for containing a carbonated beverage at least throughout the expected shelf-life which typically is the period from the bottling of the beverage to consumption. A number of materials having the above properties have been developed.
20 A preferred material for forming the container of the invention is a polyethylene terephthalate (PET) product by Shell Oil Company under No. 8006 and having an intrinsic viscosity of .80.

The container is typically blow-molded from an
25 extruded or injection molded preform or parison and has preferably been so worked that the material is biaxially oriented.

The container typically includes an upper section 10, a base section 20, and a central section 30. The upper section 10 is provided with neck portion 12 having any desired neck finish such as the threaded finish shown.

5 The threaded neck portion 12 is adapted to receive an internally threaded closure member 14 as illustrated in Figure 3. It will further be noted that the upper section 10 is formed to contain a plurality of parallel flutes 16 separated by valleys or grooves 18.

10 The base section 20 has an outer surface 22 provided with generally radially arranged contoured foot portions 24. The foot portions 24 extend outwardly and are illustrated as preferably being five (5) in number. The number of foot portions 24 is not deemed to be critical
15 and may be as low as three, the minimum number required to provide stable support on a planar surface, and the maximum number is limited only by the overall dimensions and wall thickness of the base section 20. The base section 20 is formed to contain a plurality of parallel
20 flutes 26 separated by valleys or grooves 28.

The central section 30 is formed of a plurality of juxtaposed flat panels 32 and interconnects the upper section 10 and the base section 20. It will be noted that at the juncture of the lower end of the upper section 12
25 and the upper end of the central section 30, there is an inwardly formed step caused by the reduced diameter of the central section 30. A similar inwardly formed step is

formed at the juncture of the upper end of the base section 20 and the lower end of the central section 30.

An annular outwardly extending portion 38 is formed in the base section 20 intermediate the lower termination
5 of the flutes 26 and associated valleys 28, and the upper termination of the foot portions 24.

The flutes 16, 26 and the associated valleys 18, 28 respectively, are deemed to be functional as well as aesthetic. More specifically, the valleys 18, 28 provide
10 necessary conduits of moisture formed from condensate leaving the flutes 16, 26 somewhat free from moisture when grasped by the hand of a person handling the container.

Additionally, the flutes 16, 26, the valleys 18, 28, and the flat panels 32 cooperate to lend rigidity, and
15 stiffness to the container, particularly in the unpressurized condition. Thereby, the hand of the ultimate user is left with a pleasing and comfortable reaction towards the container and its contents.

Figure 3 and 4 illustrate the container of Figures 1
20 and 2 after it has been filled with a pressurized fluid such as, for example, a carbonated beverage generally indicated by the reference numeral 40. The pressurized fluid 40 is typically filled to a fill line 41.

Upon pressurization of the container, the center
25 section 30 tends to assume a right cylindrical shape as is readily apparent from viewing Figure 4. The flat panels 32 of the unpressurized container as illustrated clearly

in Figure 2, assume a curved cross-section and the decidedly angular configuration between the panels 32 tends to disappear again as illustrated in Figure 4.

The relative smoothness of the center section 30 in the pressurized condition is of particular advantage from an identification standpoint. The trademark and contents of the internal beverage may now be applied to a separate plastic film overlay or overwrap. Due to the substantially uninterrupted exterior of the central section 30 in the pressurized state of the container, the associated film containing the printed indicia, is likewise unfettered with wrinkles or other irregularities which otherwise would adversely affect the appearance of the trademark and other recognition and advertising indicia thereon. The resultant appearance is pleasing to the ultimate consumer achieving one of the important sales objectives of the bottler of the carbonated beverage.

When the ultimate user finally loosens the closure 14 allowing the container to assume the unpressurized state, the container assumes the condition and physical configuration of Figures 1 and 2. It is in such unpressurized condition that the container returns to the more rigid condition.

An embodiment of the container illustrated in Figure 1 to 4 is illustrated in Figures 5 to 8. In describing the embodiment, prime reference numerals will be used to designate features similar to those contained in the container of Figures 1-4.

The container typically includes an upper section 10', a base section 20', and a central section 30'. The upper section 10' is provided with neck portion 12' having any desired neck finish such as the threaded finish shown. The threaded neck portion 12' is adapted to receive an internally threaded closure member 14' as illustrated in Figure 7. It will further be noted that the upper section 10' is formed to contain a plurality of parallel flutes 16' separated by outwardly extending ribs 19.

The base section 20' has an outer surface 22' provided with generally radially arranged contoured foot portions 24'. The foot portions 24' extend outwardly and are illustrated as preferably being five (5) in number. The number of foot portions 24' is not deemed to be critical and may be as low as three, the minimum number required to provide stable support on a planar surface, and the maximum number is limited only by the overall dimensions and wall thickness of the base section 20'. The base section 20' is formed to contain a plurality of parallel flutes 26' separated by outwardly extending ribs 29.

The central section 30' is formed of a plurality of juxtaposed flat panels 32' and interconnects the upper section 10' and the base section 20'. A bead or rib 34 is formed at the juncture of the lower end of the upper
5 section 12' and the upper end of the central section 30'. A similar bead or rib 36 is formed at the juncture of the upper end of the base section 20' and the lower end of the central section 30'. The preferred geometry of the container dictates that the diameter of the beads 34 and
10 36 are substantially equal.

An annular bead or rib 38 is formed in the base section 20' intermediate the lower termination of the flutes 26' and associated ribs 29, and the upper termination of the foot portions 24.

15 Additionally, the flutes 16', 26', the ribs 19, 29, and the flat panels 32, and the beads 34 and 36 cooperate to lend rigidity, and stiffness to the container, particularly in the unpressurized condition. Thereby, the hand of the ultimate user is left with a pleasing and
20 comfortable reaction towards the container and its contents.

Figure 7 and 8 illustrate the container of Figures 5 and 6 after it has been filled with a pressurized fluid such as, for example, a carbonated beverage generally
25 indicated by the reference numeral 40'. The pressurized fluid 40' is typically filled to a fill line 41'.

Upon pressurization of the container, the center section 30' tends to assume a right cylindrical shape as is readily apparent from viewing Figure 8. The flat panels 32' of the unpressurized container as illustrated
5 clearly in Figure 6, assume a curved cross-section and the decidedly angular configuration between the panels 32' tends to disappear again as illustrated in Figure 8.

When the ultimate user finally loosens the closure 14' allowing the container to assume the unpressurized
10 state, the container assumes the condition and physical configuration of Figures 5 and 6. It is in such unpressurized condition that the container returns to the more rigid condition.

Figures 9 and 10 illustrate a container which
15 typically includes an upper section 110, a base section 120, and an inwardly stepped central section 130. The upper section 110 is provided with neck portion 112 having any desired neck finish such as the threaded finish shown. The threaded neck portion 112 is adapted to receive an
20 internally threaded closure member 114 as illustrated in Figure 10. It will further be noted that the upper section 110 is formed to contain a plurality of parallel flutes 116 separated by valleys or grooves 118.

The base section 120 has an outer surface 122
25 provided with generally radially arranged contoured foot portions 124. The foot portions 124 extend outwardly and are illustrated as preferably being five (5) in number.

The number of foot portions 124 is not deemed to be critical and may be as low as three, the minimum number required to provide stable support on a planar surface, and the maximum number is limited only by the overall dimensions and wall thickness of the base section 120. The base section 120 is formed to contain a plurality of parallel flutes 126 separated by valleys or grooves 128.

The inwardly stepped central section 130 is formed of a plurality of spaced apart substantially parallel horizontal valleys 132 and interconnects the upper section 110 and the base section 120. A bead or rib 134 is formed at the juncture of the lower end of the upper section 110 and the upper end of the central section 130. A similar bead or rib 136 is formed at the juncture of the upper end of the base section 120 and the lower end of the central section 130. The preferred geometry of the container dictates that the diameter of the beads 134 and 136 are substantially equal.

An annular bead or rib 138 is formed in the base section 120 intermediate the lower termination of the flutes 126 and associated valleys 128, and the upper termination of the foot portions 124.

The flutes 116, 126 and the associated valleys 118, 128, respectively, are deemed to be functional as well as aesthetic. More specifically, the valleys 118, 128 provide necessary conduits of moisture formed from condensate leaving the flutes 116, 126 somewhat free from

moisture when grasped by the hand of a person handling the container.

It will be appreciated that the inwardly stepped central section 130 is adapted to contain a plastic sheet overlay provided with the product trademark, contents, company name, etc. The relative position or dimensions of the central section 130 with respect to the flutes 116 and 126, for example, effectively protects the plastic sheet overlay from damage which might otherwise occur in an associated vending machine or secondary packaging.

Additionally, the flutes 116, 126 and the valleys 118, 128 of the upper and lower sections, respectively, the valleys 132 of the central section 130, and the beads 134 and 136 cooperate to lend rigidity and stiffness to the container, particularly in the unpressurized condition. Thereby, the hand of the ultimate user is left with a pleasing and comfortable reaction towards the container and its contents.

Figure 10 illustrates the container of Figure 9 after it has been filled with a pressurized fluid such as, for example, a carbonated beverage. The pressurized fluid is typically filled to a desired fill line 140.

Upon pressurization of the container, the center section 130 tends to assume a right cylindrical shape as is readily apparent from viewing Figure 10. The valleys 132 of the unpressurized container, as illustrated clearly in Figure 9, assume a smooth cross-section and the

decidedly curved configuration of the valleys 132 tends to disappear as illustrated in Figure 10.

The relative smoothness of the center section 130 in the pressurized condition is of particular advantage from an identification standpoint. The indicia of the trademark and contents of the internal beverage may now be applied to a separate plastic film overlay or overwrap. Due to the substantially uninterrupted exterior of the central section 130 in the pressurized state of the container, the associated film containing the printed indicia, is likewise unfettered with wrinkles or other irregularities which otherwise would adversely affect the appearance of the trademark and other recognition and advertising indicia thereon. The resultant appearance is pleasing to the ultimate consumer achieving one of the important sales objectives of the bottler of the carbonated beverage.

When the ultimate user finally loosens the closure 114 allowing the container to assume the unpressurized state, the container assumes the condition and physical configuration of Figure 9. It is in such unpressurized condition that the container returns to the desired rigid condition.

The embodiment illustrated in Figure 11 discloses a central portion 130 having valleys 132A which are generally spaced at greater distances than the corresponding valleys 132 of the central portion 130 of the embodiment illustrated in Figures 9 and 10.

It has been found that satisfactory results have been achieved by forming the valleys 132 and 132A of the embodiments illustrated in Figures 9 to 11 from approximately 0.030" to 0.120".

The embodiment illustrated in Figure 12 discloses a central portion 130 having valleys 132B which are generally spaced more closely together than the corresponding valleys 132 of the embodiment illustrated in Figures 9 and 10.

The embodiment illustrated in Figures 13 and 14 discloses a central portion 130 having valleys 132C which extend generally vertically and are of substantially the same size as the valleys 132B of the embodiment illustrated in Figure 12.

The embodiment illustrated in Figures 15 and 16 discloses a central portion 130 having valleys 132D which extend diagonally. The valleys 132D intersect to form a plurality of diamond-shaped configurations spanning the central portion 130.

25

The embodiment illustrated in Figures 17 and 18 discloses a central portion 130 having a series of valleys 132E which extend diagonally in parallel spaced relation.

5 The embodiment illustrated in Figures 19 and 20 discloses a central portion 130 which contains a plurality of valleys 132F formed therein in a rather chicken-wire like pattern.

10 The embodiments illustrated in Figures 11 and 20 with the exception of the above distinctions are in all other aspects similar to that illustrated in Figures 9 and 10.

15 While the embodiments of the invention illustrated in the drawings contemplate the use of a foot base configuration, it will be appreciated that other base configurations could be employed without departing from the invention herein set forth.

20 In accordance with the provisions of the patent statutes, the present invention has been described in what is considered to represent its preferred embodiment. However, it should be understood that the invention can be practiced otherwise than as specifically illustrated and described without departing from its spirit or scope.

WHAT IS CLAIMED IS:

1. A plastic container having an upper section including a neck portion, a closed base section, and a central section interconnecting the upper section and the base section, the central section comprising
5 a reinforcing structure, said reinforcing structure formed of a plastic material having outwardly deformable elastic characteristics and tending to assume a circular cylindrical shape when the container
10 is pressurized.
2. A plastic container as defined in Claim 1 wherein said reinforcing structure includes a plurality of juxtaposed flat panels.
15
3. A plastic container as defined in Claim 2 wherein the upper section is formed of a plurality of juxtaposed flutes.
- 20 4. A plastic container as defined in Claim 2 wherein the base section is formed of a plurality of juxtaposed flutes extending generally upwardly toward the central portion.

25

5. A plastic container as defined in Claim 2 wherein the upper section is formed of a plurality of juxtaposed flutes extending downwardly toward the central section, and the base section is formed of a plurality of juxtaposed flutes extending upwardly toward the central section, said flutes of the upper section being equal in number to said flutes of the base section.

6. A plastic container as defined in Claim 5 wherein said panels of the central section are equal in number to said flutes in the upper section and the base section.

7. A plastic container as defined in Claim 5 wherein said flutes of the upper section and the base section are in alignment with one another.

8. A plastic container as defined in Claim 7 wherein said panels of the central section are in alignment with said flutes in the upper section and the base section.

9. A plastic container as defined in Claim 5 including an annular bead interconnecting the upper section with the central section.

10. A plastic container as defined in Claim 5 including an annular bead interconnecting the base section with the central section.

5 11. A plastic container as defined in Claim 5 including a first annular bead interconnecting the upper section with the central section and a second annular bead interconnecting the base section with the central section.

10 12. A plastic container as defined in Claim 11 wherein the base section includes generally radially arrayed contoured foot portions.

13. A plastic container as defined in Claim 1
15 wherein said reinforcing structure includes a plurality of valleys.

14. A plastic container as defined in Claim 13
wherein the upper section is formed of a plurality of
20 juxtaposed flutes.

15. A plastic container as defined in Claim 13
wherein the base section is formed of a plurality of
juxtaposed flutes extending generally upwardly toward the
25 central portion.

16. A plastic container as defined in Claim 13 wherein the upper section is formed of a plurality of juxtaposed flutes extending downwardly toward the central section, and the base section is formed of a plurality of juxtaposed flutes extending upwardly toward the central section, said flutes of the upper section being equal in number to said flutes of the base section.

17. A plastic container as defined in Claim 16 wherein the central section is stepped inwardly of the flutes of the base section.

18. A plastic container as defined in Claim 16 including an annular bead interconnecting the upper section with the upper section.

19. A plastic container as defined in Claim 16 wherein said flutes of the upper section and the base section are in alignment with one another.

20. A plastic container as defined in Claim 16 including an annular bead interconnecting the upper section with the central section.

21. A plastic container as defined in Claim 16 including an annular bead interconnecting the base section with the central section.

22. A plastic container as defined in Claim 16 including a first annular bead interconnecting the upper section with the central section and a second annular bead interconnecting the base section with the central section.

5

23. A plastic container as defined in Claim 13 wherein the base section includes generally radially arrayed contoured foot portions.

10

24. A plastic container as defined in Claim 13 wherein said valleys are annular.

25. A plastic container as defined in Claim 13 wherein said valleys are diagonal.

15

26. A plastic container as defined in Claim 13 wherein said valleys are formed in intersecting diagonal configuration.

20

27. A plastic container as defined in Claim 13 wherein said valleys are formed in chicken wire-like configuration.

28. A plastic container as defined in Claim 13 wherein said valleys are vertical.

25

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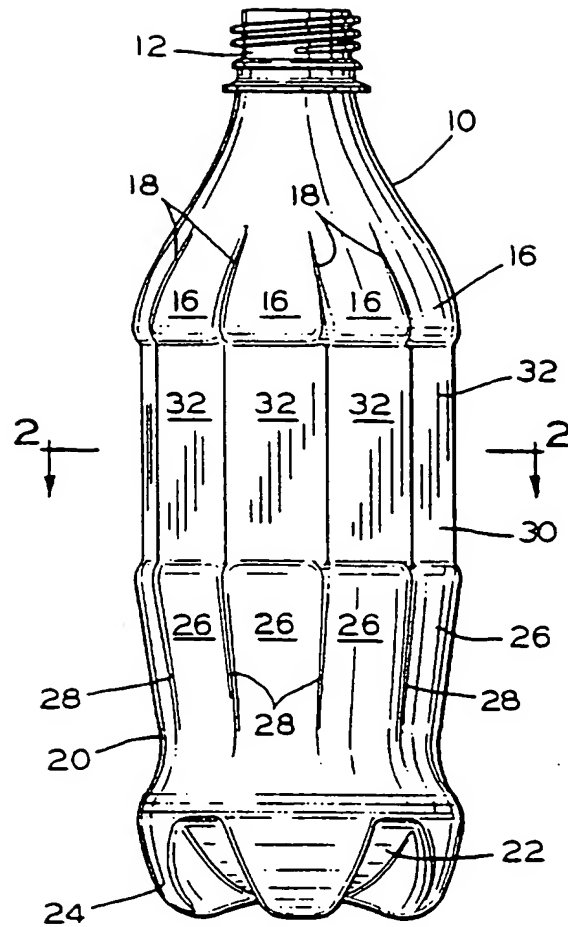


FIG. 1

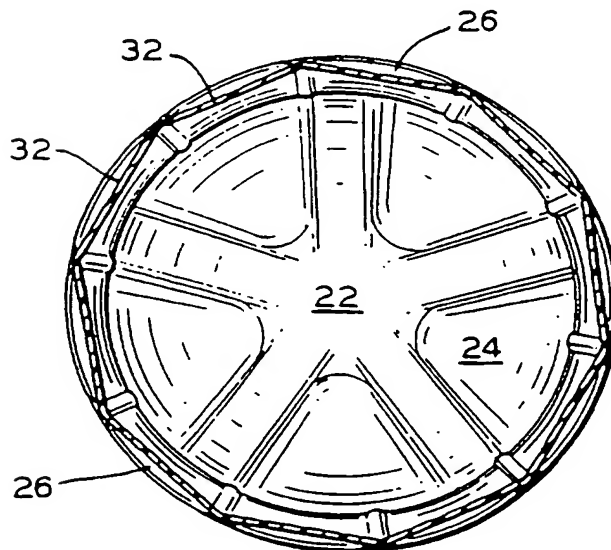


FIG. 2

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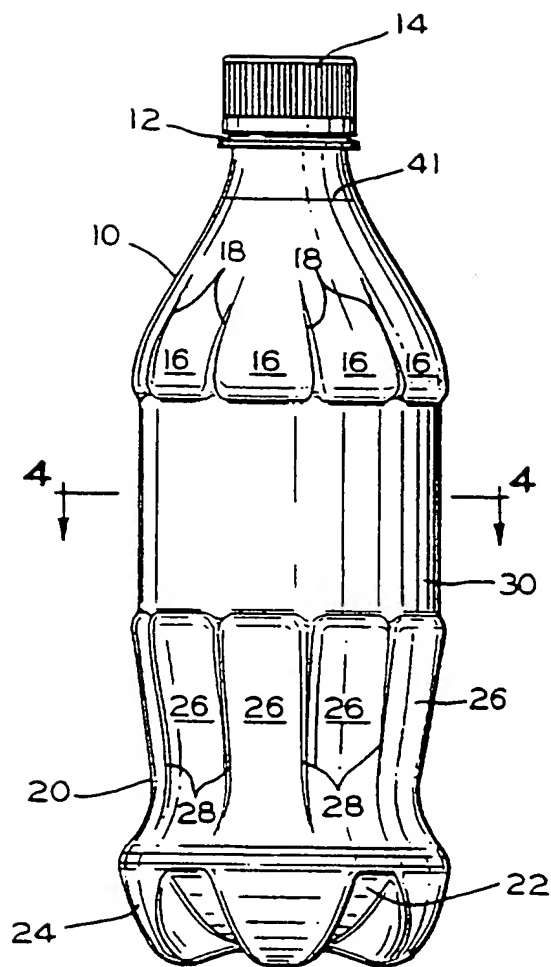


FIG. 3

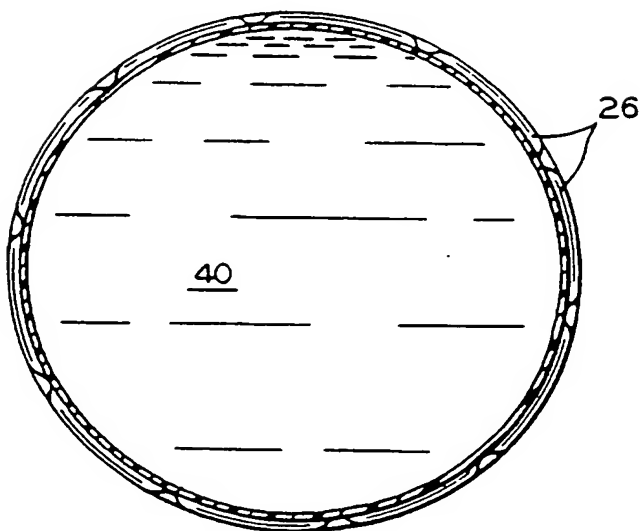


FIG. 4

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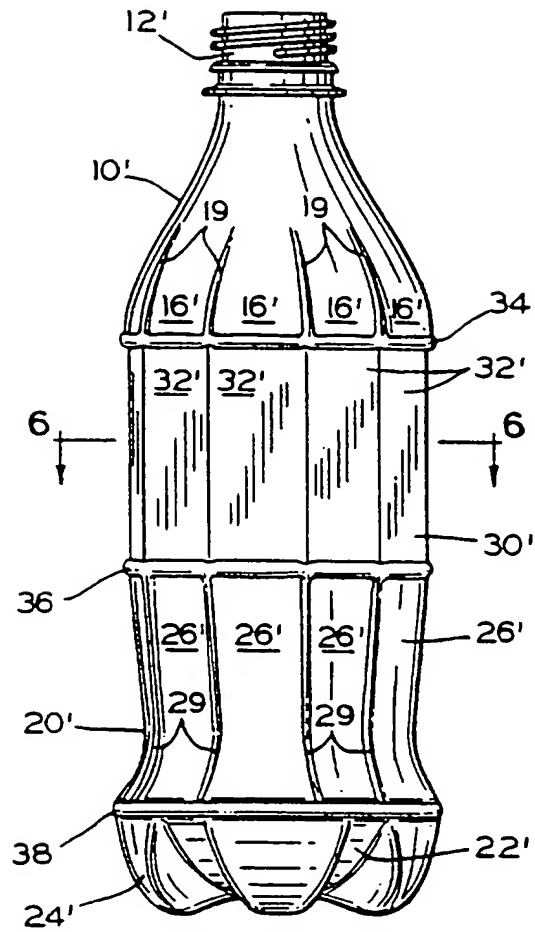


FIG. 5

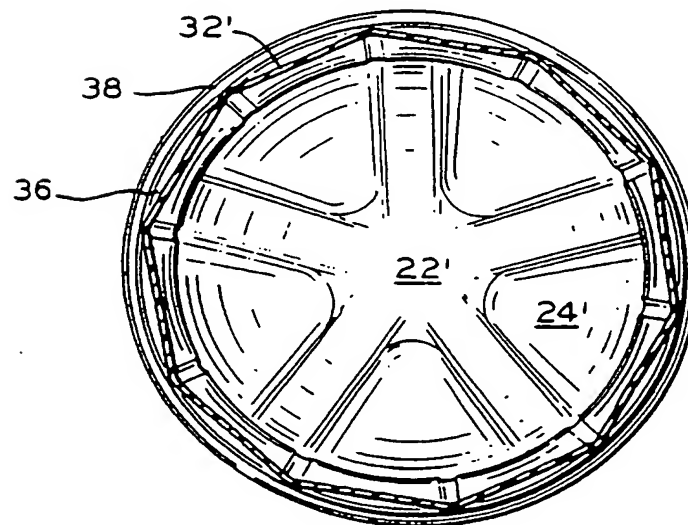


FIG. 6

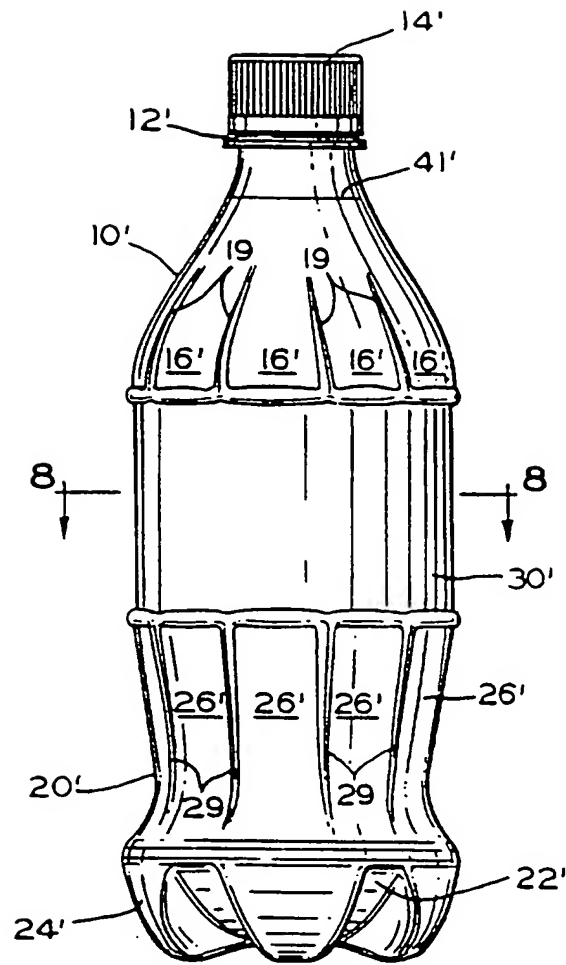


FIG. 7

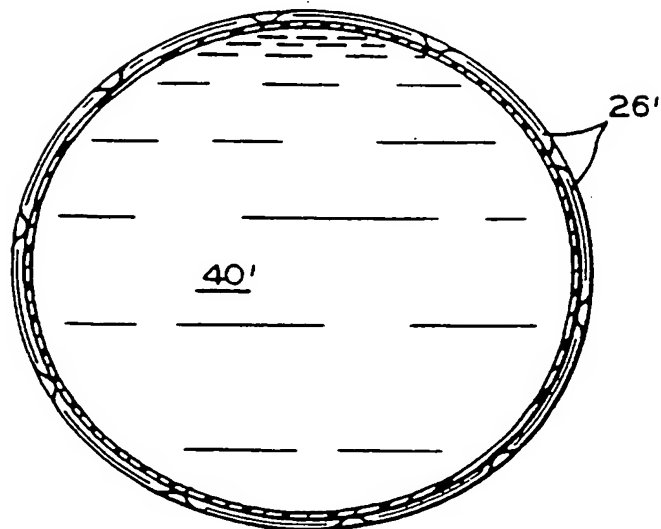


FIG. 8

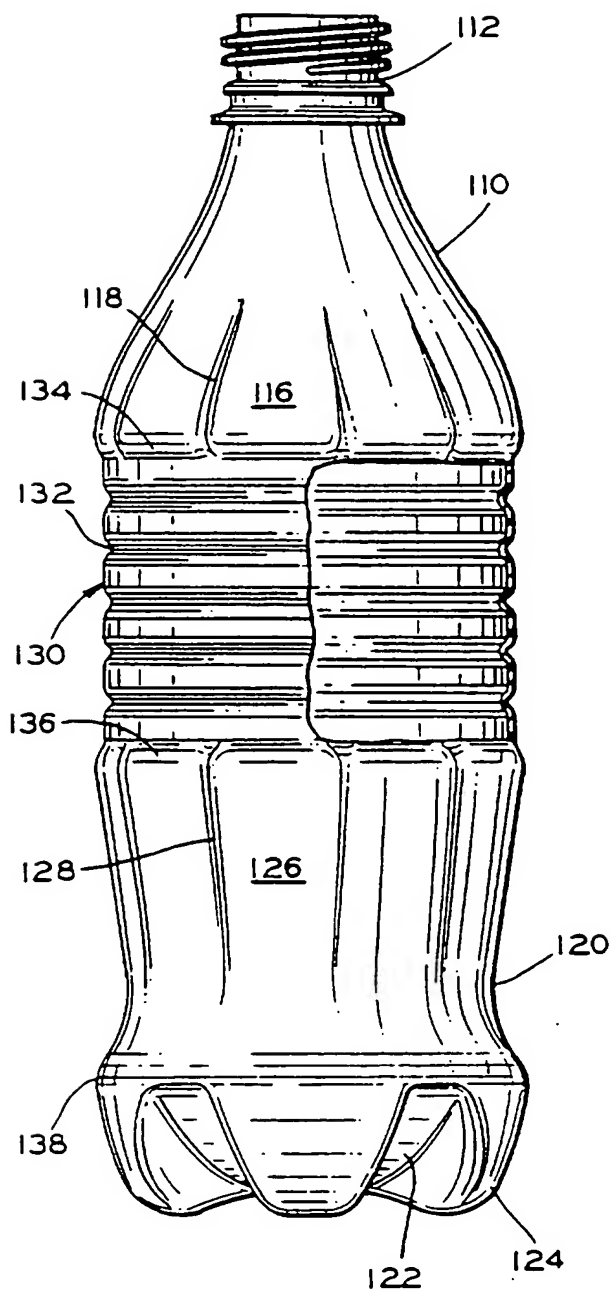


FIG. 9

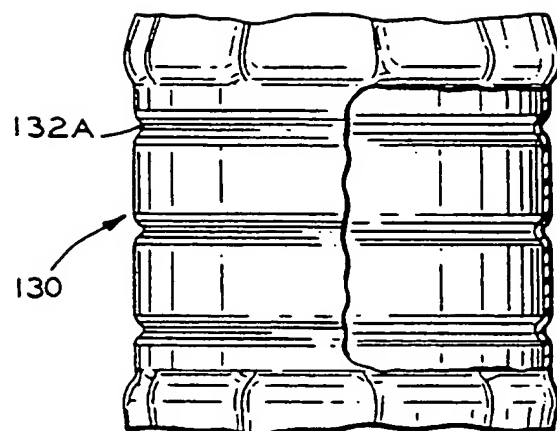


FIG. 11

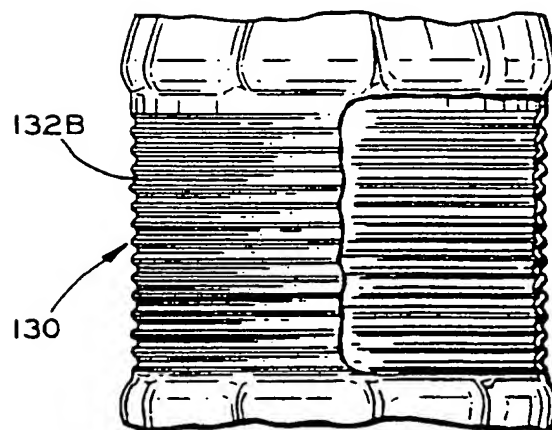


FIG. 12

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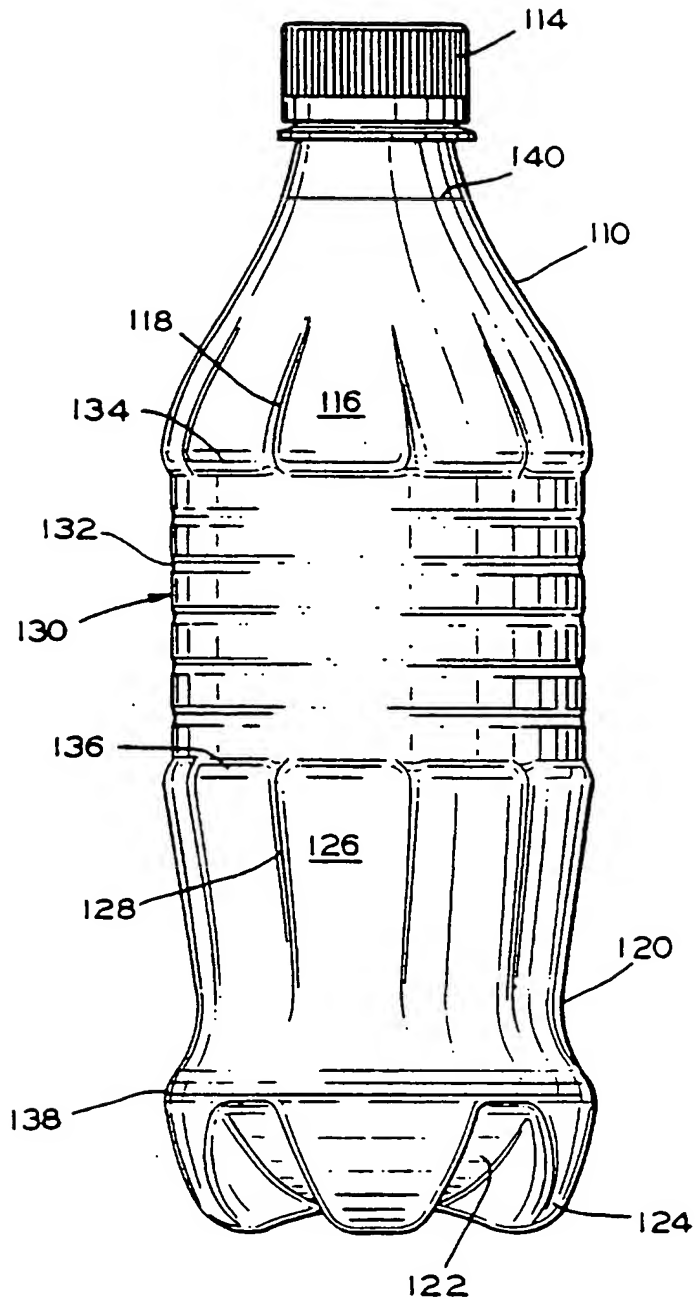


FIG. 10

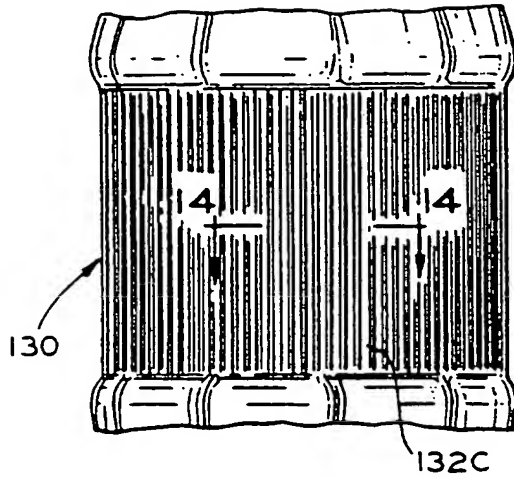


FIG. 13

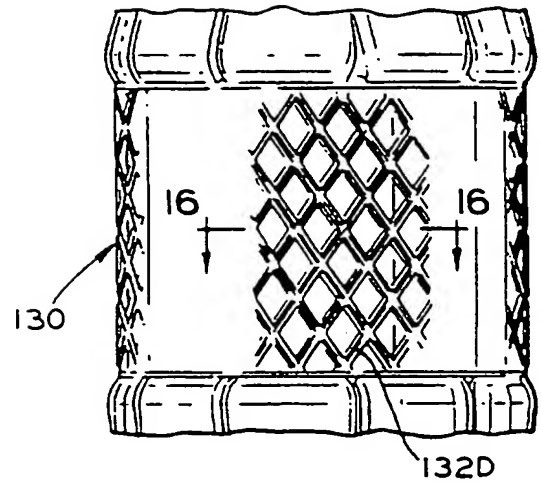


FIG. 15



FIG. 14



FIG. 16

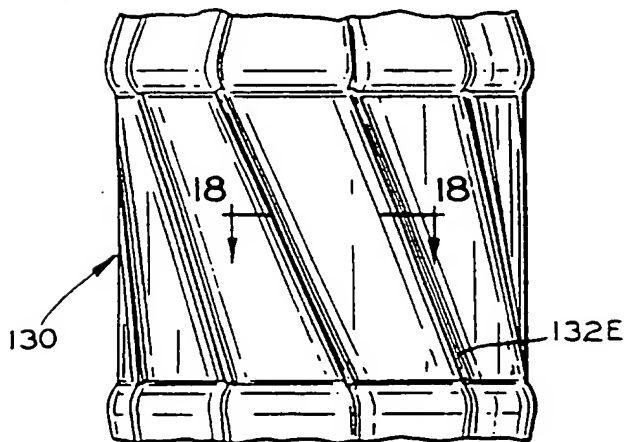


FIG. 17

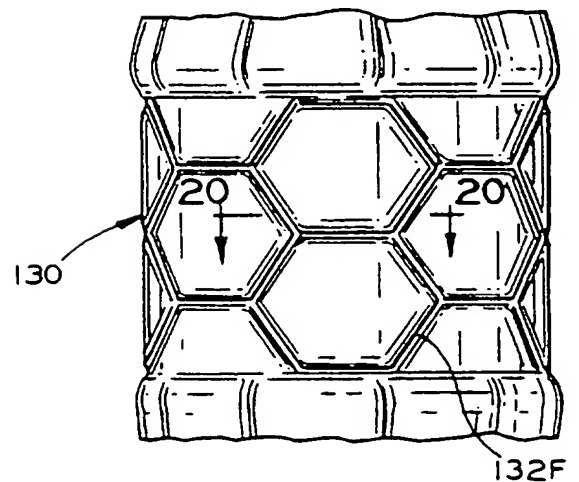


FIG. 19



FIG. 18



FIG. 20

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/14897

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : B65D 1/02

US CL : 215/375; 220/675

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 215/371-375, 381, 382; 220/669, 671-673, 675

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3,871,541 A (ADOMAITIS) 18 March 1975, figure 1.	1-28
Y	US DES.367,613 A (WEILER) 05 March 1996, fig. 2	1-8
Y	US 4,610,366 A (ESTES et al.) 09 September 1986, figs. 1 and 3	13-19,23,24
Y	US 5,224,614 A (BONO et al.) 06 June 1993, col. 4, lines 46-54 and col. 5, line 69 - col. 6 line 3.	9-11-18,20-22
Y	US 5,072,884 A (ELLISON et al.) 17 December 1991, fig. 1	25



Further documents are listed in the continuation of Box C.



See patent family annex.

<p>* Special categories of cited documents:</p> <p>*A* document defining the general state of the art which is not considered to be of particular relevance</p> <p>*E* earlier document published on or after the international filing date</p> <p>*L* document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>*O* document referring to an oral disclosure, use, exhibition or other means</p> <p>*P* document published prior to the international filing date but later than the priority date claimed</p>		<p>*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>*G* document member of the same patent family</p>
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Date of the actual completion of the international search

05 DECEMBER 1996

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